Directed flow in Au+Au collisions at AGS

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The 2-8A GeV energy range is one of only two regions between a few MeV per nucleon and CERN SPS energy where heavy-ion collisions are still largely unexplored. Collective effects observed at Bevalac/SIS energies [1] and at maximum AGS energy [2] suggest that a measurable flow signal should be observed in E895. Hydrodynamic and transport models indicate that collective effects are sensitive to various features of the nuclear equation of state at high density. Specifically, if a Quark-Gluon Plasma (QGP) phase transition occurs, hydrodynamics [3] predicts that directed flow may decline rapidly at E895 energies.

The E895 experiment investigates the global characteristics of nuclear matter at high energy and baryon density, with a specific emphasis on the beam energy dependence of collective observables. During January 1996 and November 1996, high statistics Au beam data were recorded at four beam energies: 2, 4, 6 and 8A GeV. The main E895 detector subsystem is the EOS TPC [4], located inside the MPS magnet operated with a field of 0.75 or 1 T. The TPC provides continuous tracking, nearly 4π acceptance, and particle identification via energy loss measurement.

Detection of a majority of the charged particles in the TPC allows us to study the average p_t correlation with the reaction plane directly. The global transverse momentum analysis of Danielewicz and Odyniec [5] has been performed to study the directed flow.

The impact parameter of the collision is inferred from the measured charged baryon multiplicity. The data are divided into multiplicity bins in a manner similar to the Plastic Ball analysis. The following analysis is confined to the impact parameter range where the flow signals are largest (Mult 3).

In Figure 1, we show the measured $\langle p_x \rangle$ for protons projected onto the reaction plane as a function of rapidity. The error bar includes statistical and systematic errors. The data are corrected for efficiency while pion contamination is not removed at 6A GeV. The curves are fits using linear + cubic term in y/y_{cm}.

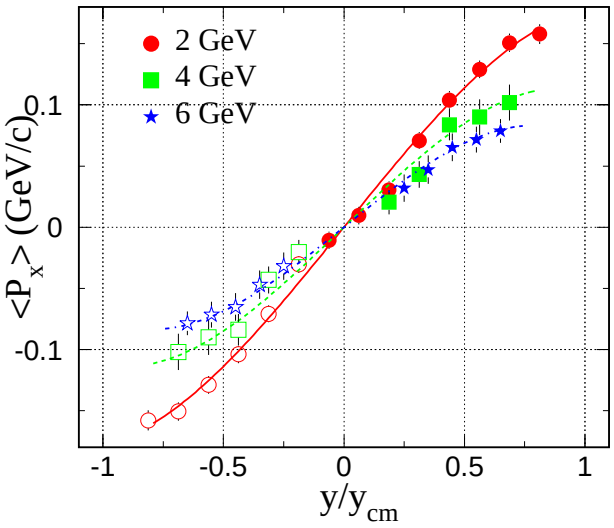

Figure 1: Average p_x as a function of normalized rapidity. The closed symbols are direct measurements and the open symbols are generated by reflection about midrapidity.

References

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